



MINISTRY OF EDUCATION, SINGAPORE  
in collaboration with  
CAMBRIDGE ASSESSMENT INTERNATIONAL EDUCATION  
General Certificate of Education Normal (Academic) Level

CANDIDATE  
NAME

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CENTRE  
NUMBER

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INDEX  
NUMBER

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## SCIENCE

**5105/02**

Paper 2 Physics

**For examination from 2024**

SPECIMEN PAPER

**Papers 1 and 2: 1 hour 15 minutes**

Candidates answer on the Question Paper.

No Additional Materials are required.

### READ THESE INSTRUCTIONS FIRST

Write your Centre number, index number and name on all the work you hand in.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

**DO NOT WRITE ON ANY BARCODES.**

#### Section A

Answer **all** questions.

Write your answers in the spaces provided.

#### Section B

Answer **one** question.

Write your answers in the spaces provided.

The use of an approved scientific calculator is expected, where appropriate.

In calculations, you should show all the steps in your working, giving your answer at each stage.

You are advised to spend no longer than 30 minutes on Paper 1.

You may proceed to answer Paper 2 as soon as you have completed Paper 1.

At the end of the examination hand in your answers to Paper 1 and Paper 2 separately.

The number of marks is given in brackets [ ] at the end of each question or part question.

This document consists of **11** printed pages and **1** blank page.



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\* 0 1 2 3 4 5 6 7 8 9 \*

**Section A**

Answer **all** the questions in this section

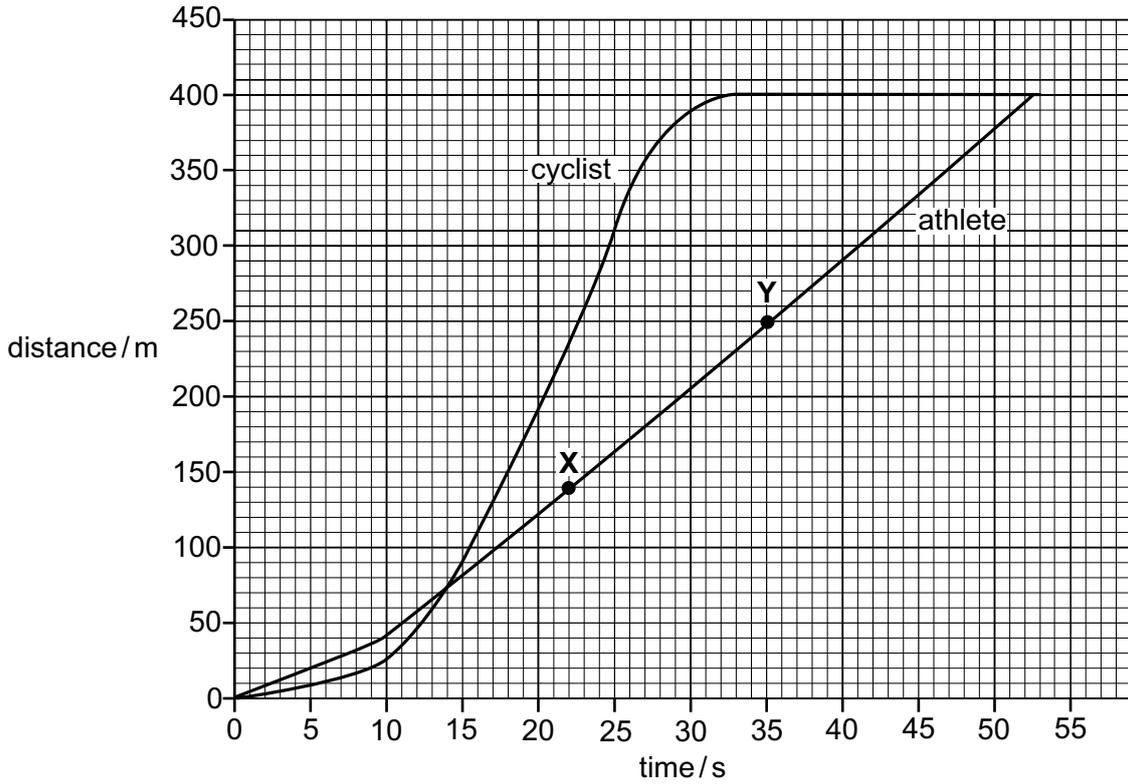
- 1 A diver, working underwater at a depth of 40 m, wears a diving helmet with a plastic window. The area of the plastic window is 100 cm<sup>2</sup>. The pressure of the air inside the helmet is 50 N/cm<sup>2</sup>.
- (a) Calculate the force exerted by the air on the plastic window.

force = ..... N [2]

- (b) State the change in arrangement of molecules when water evaporates to form water vapour.
- .....
- ..... [1]

[Total: 3]

- 2 A cyclist and an athlete run a race around a running track. The distance-time graph shows their progress during the race.



- (a) State the distance over which the race is run.

distance = ..... m [1]

- (b) How many seconds after the start of the race does the cyclist overtake the athlete?

time = ..... s [1]

- (c) State what the graph shows about the speed of the athlete between points X and Y.

.....  
 ..... [1]

[Total: 3]

- 3 A student investigates how changing the potential difference (p.d.) across a light-emitting diode (LED) affects the current in it.

She uses connecting wires and the components represented by these symbols.



- (a) Using the correct symbols, draw a circuit diagram of a suitable circuit for the student to use to carry out her investigation.

[3]

- (b) The student's table of results is shown.

p.d./V	current/mA
0.0	0
0.5	0
1.0	0
1.5	2
2.0	4
2.5	12
3.0	22

The student states that the results show that the resistance of the LED is constant.

Explain whether you agree with the student.

.....  
 ..... [1]

[Total: 4]

- 4 The photograph shows the image observed as a water wave passes across a ripple tank.



to scale

- (a) Determine an accurate value for the wavelength of the wave, in cm.

wavelength = ..... cm [2]

- (b) The wave travels at a speed of 42 cm/s. Using your answer to (a), calculate the frequency of the wave.

frequency = ..... Hz [2]

[Total: 4]

5 Sodium-24 is a radioactive isotope of sodium with the nuclide notation  ${}_{11}^{24}\text{Na}$ .

(a) What is the sign of the charge on a nucleus of sodium-24?

..... [1]

(b) When a nucleus of sodium-24 undergoes radioactive decay, it emits a  $\beta$ -particle and  $\gamma$ -rays.

(i) State another name for a  $\beta$ -particle.

..... [1]

(ii) State **one** hazard that is the result of exposure to nuclear radiation.

..... [1]

(iii) Even though exposure to nuclear radiation is known to be hazardous, sodium-24 is used in medical diagnosis.

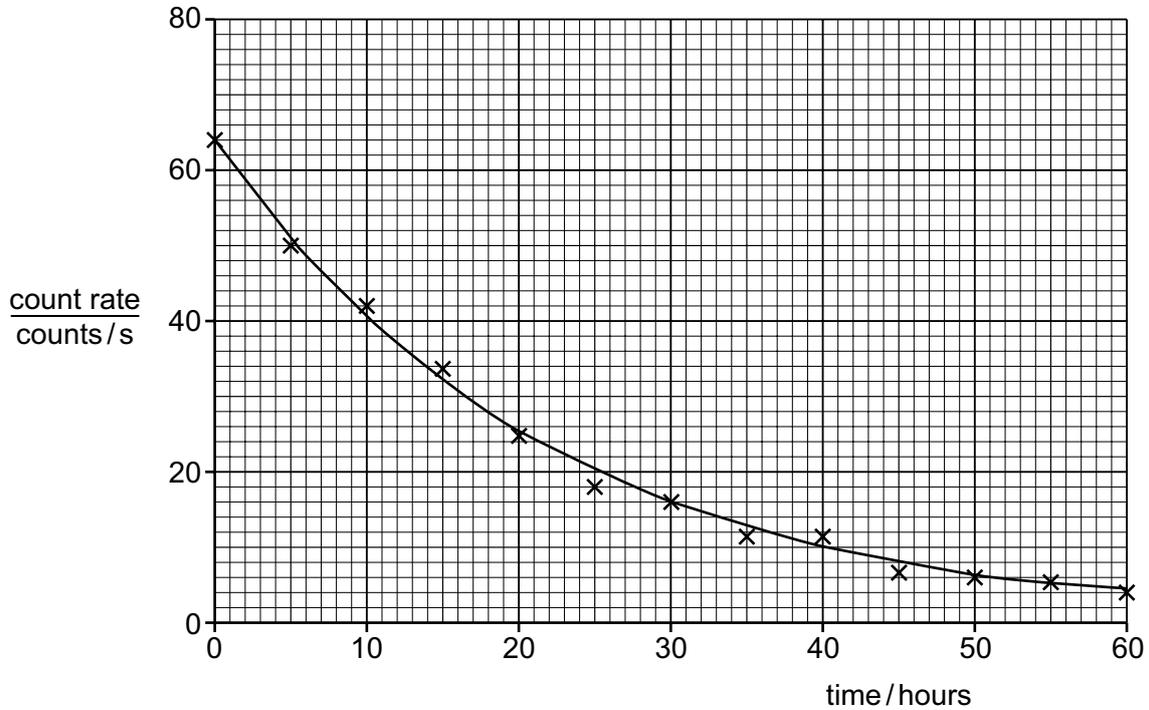
Suggest why this is sensible.

.....  
..... [1]

(c) A sample of sodium-24 is placed near to a radiation detector.

The reading on the detector is recorded every 5 hours for 60 hours after the detector is switched on.

The crosses on the graph show the readings recorded. The best-fit smooth curve for these readings is shown.



(i) Use the graph to find the count rate 30 hours after the detector is switched on.

count rate = ..... counts/s [1]

(ii) Use the value from (c)(i) to determine the half-life of sodium-24.

half-life = ..... hours [2]

(iii) Some of the readings do **not** lie on the smooth curve.

Explain whether the result obtained in (c)(ii) is reliable.

.....  
 ..... [1]

[Total: 8]

**Section B**

Answer **one** question from this section.

- 6 The diagram shows an astronaut on a spacewalk. His space suit is designed to stop infrared radiation from the Sun reaching his body.



- (a) State the colour of the material which is best at keeping the astronaut cool.

Explain your answer.

.....  
.....  
..... [2]

- (b) Infrared radiation is a transverse wave.

State how a transverse wave differs from a longitudinal wave.

..... [1]

- (c) On the Moon, a rock has a weight of 25 N. The astronaut lifts this rock through a vertical distance of 2.0 m.

Calculate the work done on the rock.

work done = ..... J [2]

(d) The gravitational field strength on Earth is 10 N/kg. The gravitational field strength on the Moon is 1.6 N/kg.

(i) On Earth, the weight of the astronaut is 720 N.

What is the mass of the astronaut?

mass = ..... kg [1]

(ii) What is the weight of the astronaut on the Moon?

weight = ..... N [2]

[Total: 8]

7 The diagram shows an electric travel mug that is used in a car to heat water.



The mug is plugged in and switched on. Energy present in the car battery is transferred to the water.

(a) What is the name of the potential energy store in the car battery?

..... [1]

(b) The heater is in the base of the mug, so the temperature of the water at the base increases first.

Convection causes the temperature of all the water in the mug to increase.

Describe how convection is produced in the water.

.....  
.....  
..... [2]

(c) The temperature of the water increases.

State and explain what happens to the amount of energy present in the water.

.....  
.....  
..... [2]

(d) The electromotive force (e.m.f.) of the car's battery is 12V and the current in the heater in the mug is 15A.

(i) Calculate the power of the heater.

power = ..... W [2]

(ii) Explain whether a 12A fuse is suitable for the heater circuit.

.....  
..... [1]

[Total: 8]

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